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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : B23P 15/00, B21K 1/08, F16C 3/08

A1

(11) International Publication Number: **WO 00/47362**

(43) International Publication Date: 17 August 2000 (17.08.00)

(21) International Application Number: PCT/GB00/00438

(22) International Filing Date: 11 February 2000 (11.02.00)

(30) Priority Data:
9902979.5 11 February 1999 (11.02.99) GB

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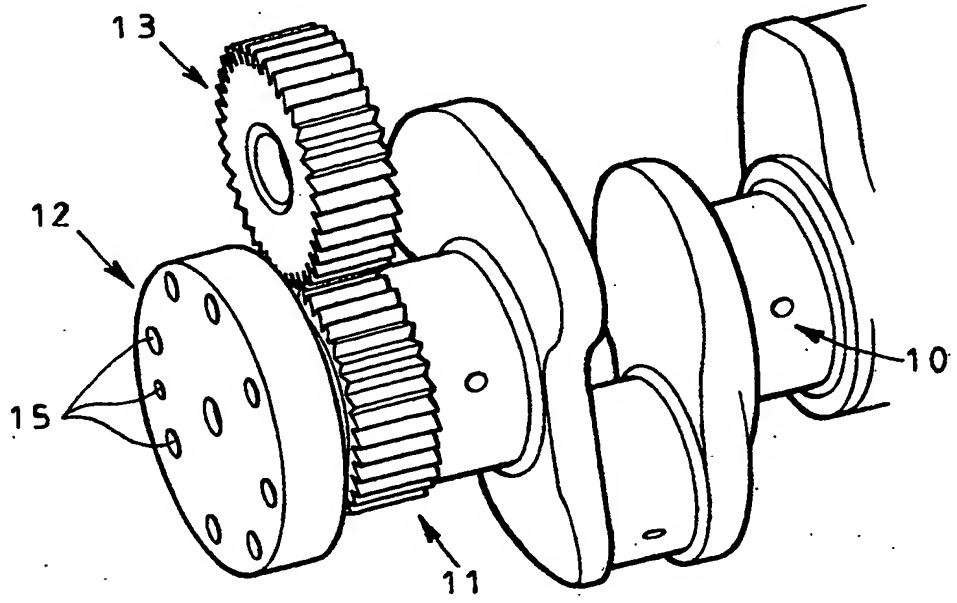
(81) Designated States: BR, CZ, JP, MX, PL, SK, US, Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: CRANKSHAFT CONSTRUCTION



(57) Abstract

A steel crankshaft for an internal combustion engine is formed in which the crankshaft has cranks along a portion of its length and carries at one end a gear wheel (11) and a flange (12) for a flywheel. The gear wheel lies between the cranks (10) and the flange (12) and the crankshaft is made by forming the cranks, the gear wheel and the flange as an integral unit by forging, machining the gear wheel to form gear wheel teeth, and then subjecting the gear wheel to heat treatment.

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CRANKSHAFT CONSTRUCTION

This invention relates to crankshafts and to a method for their construction, in particular, crankshafts for internal combustion engines notably diesel engines.

Crankshafts have conventionally been made which have a gear wheel for driving a gear train located at one end of the cranks and a flange mounted at the opposite end of the crankshaft for mounting a flywheel. By placing the gear wheel at the other end of the crankshaft adjacent the flywheel flange benefits can be achieved, for example, a reduction in noise and improved efficiency. However to place the gear wheel between the cranks and the flywheel flange poses manufacturing problems since this would normally involve placing the gear wheel on a reduced diameter of the crankshaft and then fitting a flywheel flange. This involves a high degree of control on the fitting process to ensure that the flywheel flange remains secure to the crankshaft with no possibility of loosening in service and the gear wheel also has to be accurately and securely fitted to the crankshaft.

An object of the invention is to provide an improved crankshaft and crankshaft construction method.

According to the invention there is provided a method of forming a steel crankshaft for an internal combustion engine in which the crankshaft has cranks along a portion of its length and the crankshaft carries at one end a gear wheel and a flange for a flywheel, the gear wheel lying between the cranks and the flange, the method including the steps of forming the cranks, the gear wheel and the flange as a single integral unit by forging, machining the gear wheel to form gear wheel teeth, and then subjecting the gear wheel to heat treatment to obtain the desired characteristics for the gear wheel.

Preferably, the heat treatment is achieved using induction heating of the gear wheel.

The gear wheel is intended to drive the valves for the engine through a train of gears meshing with the crankshaft gear wheel. The flange is arranged for connection to a flywheel. In a usual configuration the flywheel and gear wheel are located to the rear of the engine which is usually a diesel engine.

The invention also provides a steel crankshaft for an internal combustion engine comprising a crankshaft having cranks along one portion of its length, and at one end a gear wheel and a flange for a flywheel, the gear wheel lying between the cranks and the flange, and the cranks, the gear wheel and the flange being formed as a unitary construction by forging and subsequent machining of the gear wheel, at least the gear wheel having been subjected to heat treatment following the formation of gear teeth.

Heat treatment of the gear wheel ensures that the gear wheel teeth are hardened and finished to a specification suitable for the gear wheel.

By this arrangement a crankshaft and integral gear wheel and flange are formed which obviate the need to secure, fit and align different components to the crankshaft.

Further features of the invention will appear from the following description of an embodiment of the invention given by way of example only and with reference to the drawings in which Fig 1 is a perspective view of a finished unitary crankshaft construction, and Fig 2 is a view of the construction after forging.

Referring to the drawings a unitary crankshaft is shown which is intended to be particularly suitable for a diesel engine and which is normally located in a vehicle with its longitudinal axis extending in the fore and aft direction of the vehicle.

The crankshaft has a series of cranks 10 (only some of which are shown) extending along the crankshaft. To the rearward end of the crankshaft there is located a timing gear wheel 11 and, at the rearmost end, a flange 12. The gear wheel 11 is for driving engagement with a

train of timing gears, only one of which 13 is shown, in the usual manner for connection to valve operating means (not shown). The flange 12 is apertured at 15 for connection to an engine flywheel (not shown) in the usual manner. In Fig 2 the construction is shown after the forging operation and before the gear wheel is formed with gear teeth.

At the forward, opposite end of the crankshaft (not shown) the crankshaft is of conventional construction having shaft portions to be received in bearings.

In Fig 1 the crankshaft and associated gear wheel 11 and flange 12 is in its finished condition. The crankshaft is made in one piece by forging so that the cranks 10, the gear wheel 11 (without teeth) and the flange 12 are formed from one piece of metal. Subsequent to the forging operation the gear wheel is machined to provide the desired tooth form for the gear wheel, as shown. Since the characteristics of the metal of the gear wheel need to be specific to its function, ie hardened to the necessary specification, a separate hardening operation is then performed on the gear wheel by heat treatment. Preferably this is achieved by induction heating of the gear wheel 11 portion.

Following the gear cutting operation on the gear wheel 11 and the heat treatment stage the unitary crankshaft construction is ready for use. In this form it is ensured that the gear wheel and the flange are secure with the crankshaft and at the desired centres, with no possibility of these components loosening in service. Conveniently the steel of the crankshaft is SAE 1548, SAE 1046 or micro-alloy steel.

Claims

1. A method of forming a steel crankshaft for an internal combustion engine in which the crankshaft has cranks along a portion of its length and the crankshaft carries at one end a gear wheel and a flange for a fly wheel, the gear wheel lying between the cranks and the flange, the method including steps of forming the cranks, the gear wheel and the flange as a single integral unit by forging, machining the gear wheel to form gear wheel teeth, and then subjecting the gear wheel to heat treatment to obtain the desired characteristics for the gear wheel.

2. A method according to claim 1 wherein the heat treatment uses induction heating of the gear wheel.

3. A steel crankshaft for an internal combustion engine comprising a crankshaft having cranks along one portion of its length, and at one end a gear wheel and a flange for a gear wheel, the gear wheel lying between the cranks and the flange, and the cranks, gear wheel and the flange being formed as a unitary construction by forging and subsequent machining of the gear wheel, at least the gear wheel having been subjected to heat treatment following the formation of gear teeth.

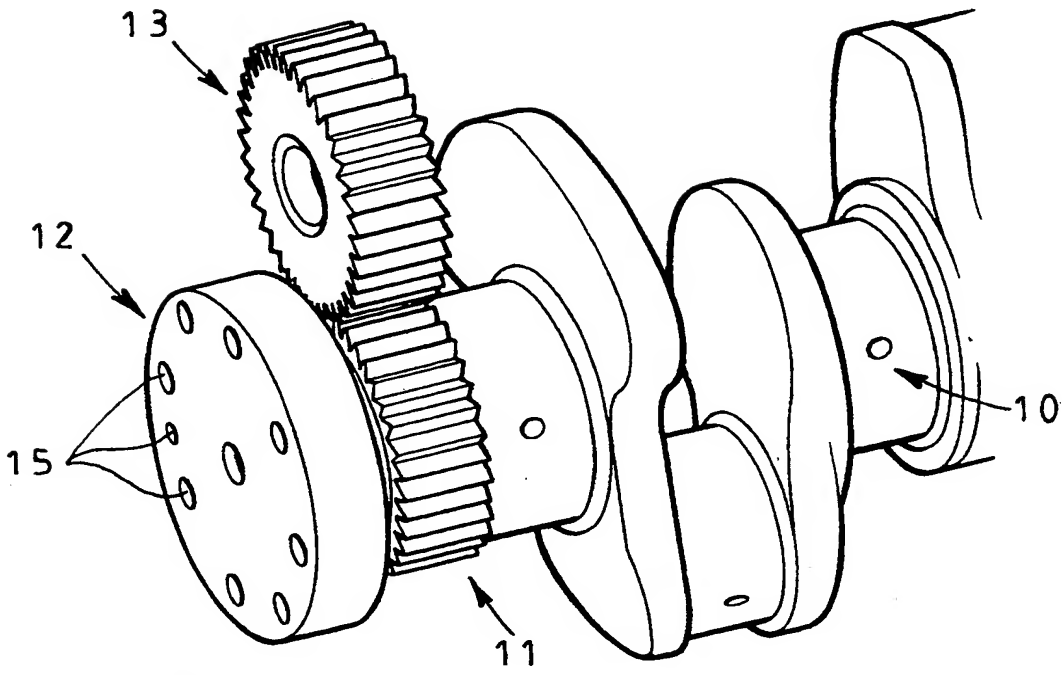

FIG 1

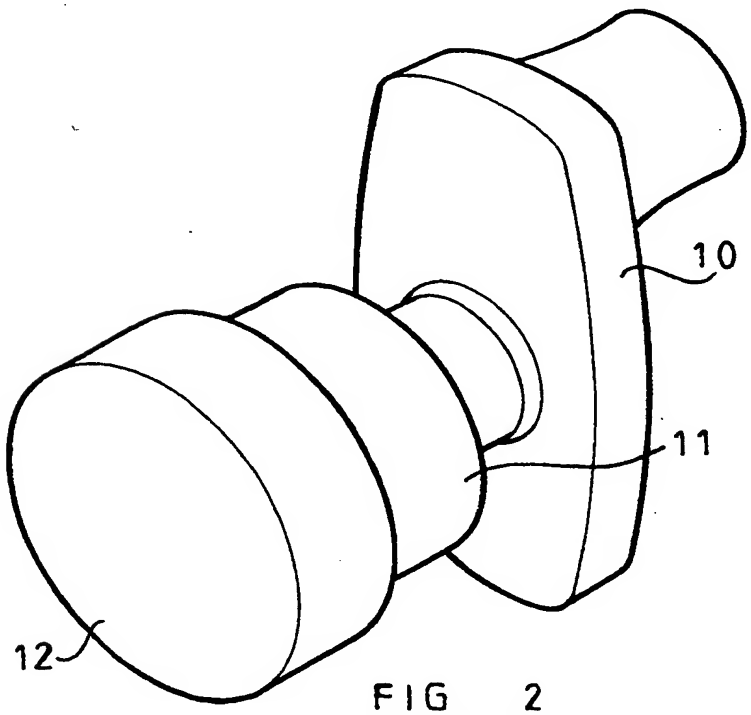

FIG 2

INTERNATIONAL SEARCH REPORT

Int. tional Application No
PCT/GB 00/00438

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B23P15/00 B21K1/08 F16C3/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B23P B21K F16C C21D B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 484 (M-776), 16 December 1988 (1988-12-16) & JP 63 203226 A (TOYOTA MOTOR CORP), 23 August 1988 (1988-08-23) abstract	1-3
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
25 May 2000	02/06/2000

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int tional Application No
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